FLOOD PLAIN INFORMATION

FARMINGTON AND CONNECTICUT RIVERS

WINDSOR
CONNECTICUT

PREPARED FOR
THE TOWN OF WINDSOR
BY
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS
MARCH 1971

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INTRODUCTION

The purpose of this report is to describe the flood situation along the Connecticut and Farmington Rivers in the town of Windsor, Connecticut. The study was requested by the town of Windsor through the Water Resources Commission of the State of Connecticut to provide information to aid in the solution of local flood problems, to best utilize land subject to overflow and to establish a basis for zoning and other regulatory measures relative to development in the flood plains. The report is prepared from information on rainfall, runoff, historical flood heights and other technical data bearing upon the occurrence and size of floods in the Windsor area. It is intended to encourage those affected to help themselves.

The report covers two phases of the flood situation in Windsor. The largest known historic floods on the Connecticut and Farmington Rivers are first related, followed by a discussion of the probability of future floods of various magnitudes that may occur, namely, the Intermediate Regional Flood and the Standard Project Flood. The Intermediate Regional Flood is a flood that has an average frequency of occurrence in the order of once in 100 years or a 1% chance of occurrence in any year. It is determined from an analysis of known floods

on the Connecticut and Farmington Rivers and other streams that have similar physical characteristics and are in the same geographical region. The Standard Project Flood (defined in the Glossary of this report) is a flood of rare occurrence, and on most streams is considerably larger than any natural flood that is known to have occurred in the past. For the purpose of this report all estimates of future flooding reflect the protection from 13 flood control dams on the Connecticut River and 3 on the Farmington River. These future floods, therefore, are considered to be modified.

In problems concerned with the control of future development in the flood plains of the Connecticut and Farmington Rivers, the size of floods which may be encountered should be carefully considered. Appropriate consideration should be given not only to possible future occurrence of floods of past record magnitude, but also the Intermediate Regional Flood and the Standard Project Flood.

This report contains plans and profiles, which portray the extent of flooding that has been experienced in the past and that which might occur in the future in the Windsor area. Such information can be useful in planning the best use of the flood plains. From these data, the depth of probable flooding by recurrence of the largest known floods or by occurrence of the Intermediate Regional or Standard Pro-

ject Floods at any location may be learned. With this information, all types of new construction may be planned high enough to avoid flood damage. If constructed at lower elevations, recognition of the chance and hazards of flooding should be taken into consideration.

This report does not include plans for the solution of flood problems. It is intended to provide the basis for further study and planning by the town of Windsor in order that guidelines and local planning programs might be continued which will control the uses to which flood plain land is subjected. This may come about through revised zoning laws or subdivision regulations and possibly through the construction of some minor flood protection works.

This report is not intended to extend any Federal authority over zoning or other regulation of flood plain use, and the report is not to be construed as committing the Federal Government in the future to investigate, plan, design, construct, operate or maintain any facilities discussed, or to imply any intent to undertake such activities unless specifically authorized by Congress. It is intended, as mentioned before, as an aid to local authorities.

The New England Division of the Corps of Engineers will provide upon request, technical assistance to Federal, State and local agencies in the use of the information contained herein, and will provide other available flood data related thereto.

SUMMARY OF FLOOD SITUATION

Windsor is in the central part of the State of Connecticut about five miles north of the city of Hartford on the west bank of the Connecticut River at the confluence of the Farmington River. (See Plates 1 and 2.) This report covers 7.0 miles along the right bank of the Connecticut River and 11.5 miles along both banks of the Farmington River within the town limits of Windsor. The principal residential development is on high ground above flood level, but there are commercial and some residential developments in the flood plains of both rivers. These have been inundated by floods of the past and will be flooded again by the potentially greater floods of the future. The U.S. Geological Survey maintains two stream gaging stations in the area. One is located upstream at Thompsonville and the other is within the town of Windsor on the Farmington River at Rainbow. The United States Department of Commerce Weather Bureau operates a river gage station downstream from Windsor at Hartford. Residents along the rivers have been interviewed and newspaper files and historical documents have been searched for information concerning past floods. From these investigations and from studies of possible future floods on the Connecticut and Farmington

Rivers, the local flood situation has been developed. The following paragraphs summarize the significant findings which are discussed in more detail in succeeding sections of this report.

* * *

THE GREATEST FLOODS known to have occurred on the Connecticut River and the lower stretch of the Farmington River occurred in March 1936. The greatest known flood on the Farmington River above the backwaters of the Connecticut River occurred in August 1955. Newspapers and records point out the disastrous proportions of these floods in Windsor and leave no doubt that they were far greater than any other known floods.

* * *

ANOTHER GREAT FLOOD which is the second highest flood on the Connecticut River occurred in September 1938. This flood was about 2 feet lower than the March 1936 flood in the vicinity of the confluence of the Farmington and Connecticut Rivers. Above the backwater of the Connecticut River on the Farmington River the second highest flood occurred in March 1936 and was about 2 feet lower than the August 1955 flood above Rainbow Dam.

* * *

OTHER LARGE FLOODS on the Connecticut River at Windsor occurred in August 1955, May 1854 and November 1927. The 1955 flood on the Connecticut River was about 5 feet lower than the flood in 1936, while the floods of 1854 and 1927 were about 8 feet lower. The floods of December 1948 and September 1938 on the Farmington River were about 3 feet lower than the August 1955 flood above Rainbow Dam.

* * *

INTERMEDIATE REGIONAL FLOOD is a flood that has an average frequency of occurrence in the order of once in 100 years, or in each year there is a 1% chance of occurrence. It is determined from a statistical analysis of floods on the Connecticut and Farmington Rivers and other streams in the same general area. The analysis indicates that the Intermediate Regional Flood for the Connecticut River is about the same size as the experienced November 1927 flood. On the Farmington River the Intermediate Regional Flood is about 1 foot below the maximum known flood (August 1955) above Rainbow Dam and about 6 to 8 feet below the experienced August 1955 or March 1936 floods below the dam. These analyses show the effect of the 16 flood control reservoirs that will be in operation at the time of the floods.

STANDARD PROJECT FLOOD is a flood of rare occurrence and, on most streams, is considerably larger than any flood that has occurred in the past. However, it should be considered in planning for use of the flood plains. The Standard Project Flood on the Connecticut River in the vicinity of Windsor is approximate but is one which is well within the realm of probability. It was estimated that this flood would attain the same elevations as were experienced in March 1936. The Standard Project Flood determinations on the Farmington River in Windsor, which also must be realized, would be equivalent to the experienced March 1936 flood for about one mile upstream of the Palisado Avenue bridge (Route 5A) and equivalent to the experienced August 1955 flood from here to the town line. The Standard Project Floods for these two rivers in this area would reach much higher elevations if it were not for the flood control reservoirs that will be in operation at the time of flooding.

* * *

FLOOD DAMAGES caused by the Intermediate Regional Flood and Standard Project Flood would be extensive because of the large area that would be inundated and the depth of water.

MAIN FLOOD SEASON for the Farmington and Connecticut Rivers is in the spring. These floods are caused by a combination of heavy rain and melting snow. Floods, however, have occurred in every month of the year. In the fall, some of the flooding has been caused by heavy rains preceding and accompanying the tropical hurricanes that pass over southern New England.

* * *

DURATION OF FLOODS is relatively long on the Connecticut and lower Farmington Rivers in Windsor. Stages on the Connecticut River have taken more than three days to rise from normal flow to extreme flood peaks and have taken longer to subside. During the flood of March 1936 the Connecticut had a rate of rise of about 4 inches per hour and remained at flood stage for about 7 days. This flood crested about 34 feet above normal water levels.

* * *

FLOOD DAMAGE PREVENTION MEASURES in the Connecticut River Valley as well as in other drainage areas in New England is an active program of the New England Division, Corps of Engineers. For the purpose of this report, 16 flood control reservoirs will be in operation at the time of a future flood. There are no existing, authorized or proposed flood control or related measures in the study area. Encroachment lines have been established along the Connecticut River in Windsor. Beyond these lines, in the direction of the waterway or

flood-prone area, no obstruction or encroachment shall be placed unless authorized by the State of Connecticut Water Resources Commission.

* * *

FUTURE FLOOD HEIGHTS that would be reached if the Intermediate Regional Flood (same as November 1927), the September 1938 flood and the Standard Project Flood (same as March 1936) should reoccur in the vicinity of Windsor on the Connecticut River are shown on Table 1. The table gives the comparison of their flood crests and also shows the comparison at the mouth of the Farmington River, with the most recent major flood which occurred in August 1955 on the Connecticut River.

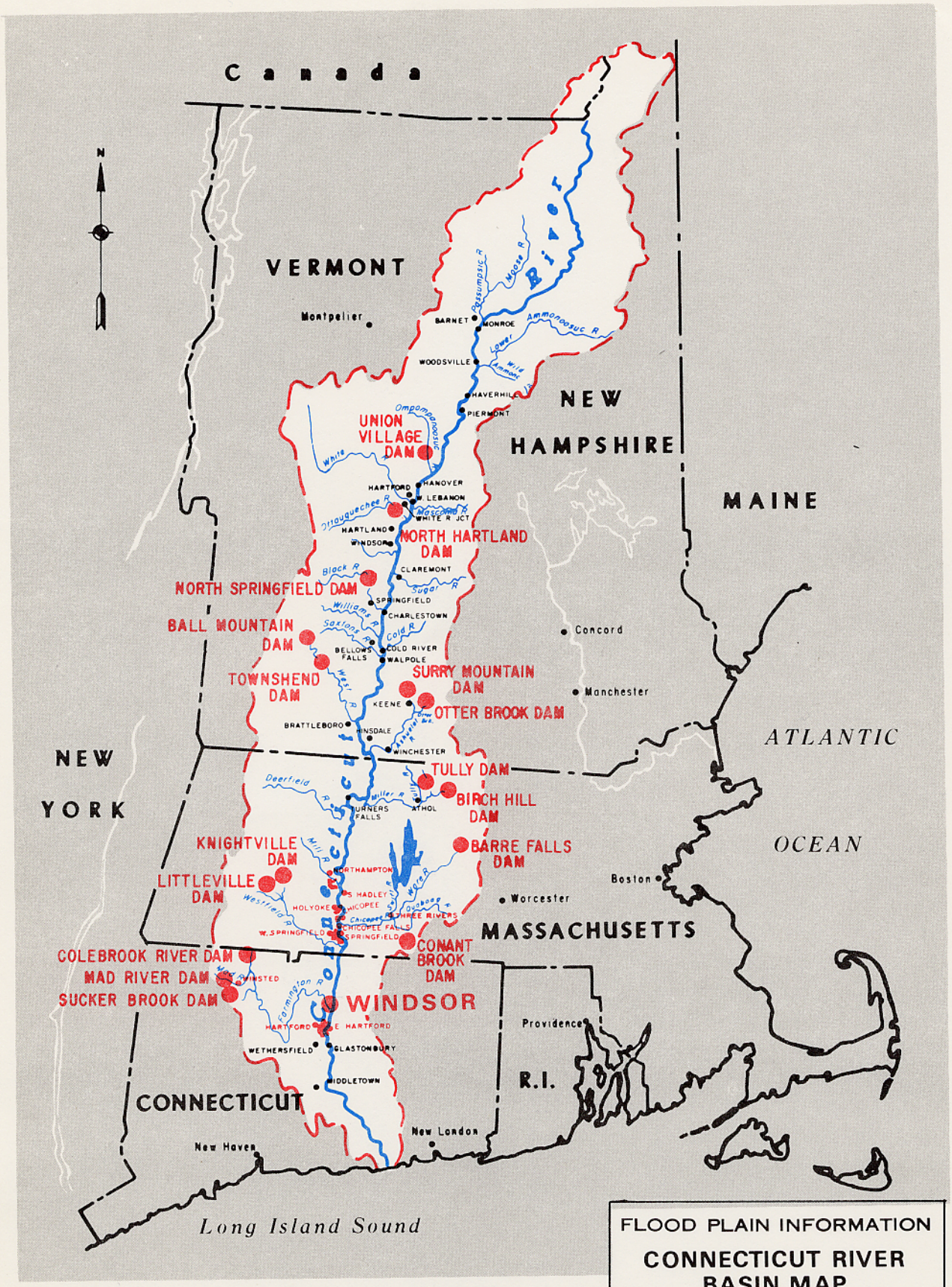
TABLE 1

RELATIVE FLOOD HEIGHTS

Confluence of Farmington & Connecticut Rivers

Flood	Estimated Peak Discharges cfs	Elevation feet m. s. l.	Relation to August 1955 Flood feet
August 1955	210,000	33.2	0
September 1938	251,000	36.6	+3.4
Intermediate Regional (November 1927)	176,000	30.5	-2.7
Standard Project (March 1936)	313,000	38.5	+5.3

All discharges in Windsor area are relative to the hydraulic control at Bodkin Rock in Middletown.

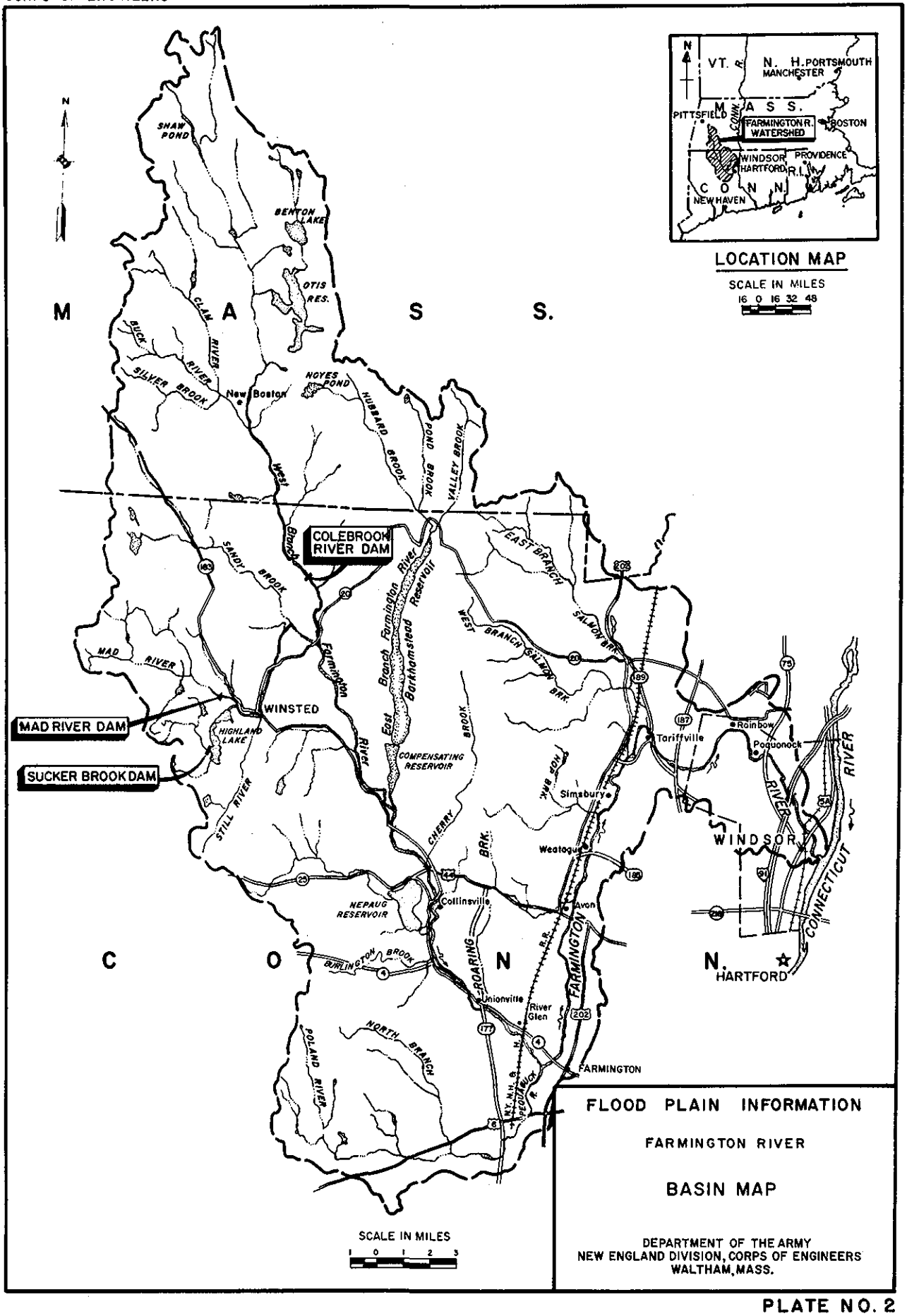


FLOOD PLAIN INFORMATION

CONNECTICUT RIVER BASIN MAP

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

PLATE 1



FLOOD PLAIN INFORMATION

FARMINGTON RIVER

BASIN MAP

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

PLATE NO. 2

GENERAL CONDITIONS AND PAST FLOODS

Settlement

This section of the report is a history of floods on the Connecticut and Farmington Rivers in Windsor, Connecticut. The town, the oldest in Connecticut, has grown from a trading post established in 1633 to a town with a population of more than 22,000. Located in the central part of the state about five miles north of the capital city of Hartford in Hartford County, it is on the right bank of the Connecticut River at the confluence of the Farmington River and about 58 miles above its mouth in Long Island Sound.

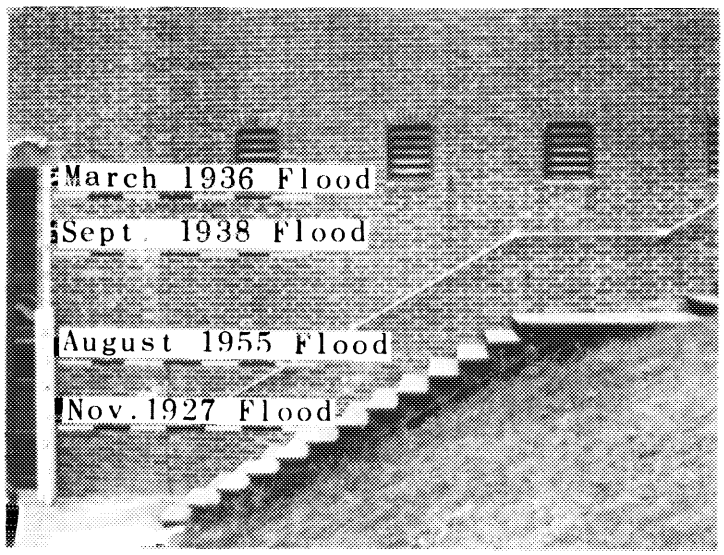
The wide flood plains in the area are conducive to the growth of tobacco. This has contributed significantly to the agricultural income in the state and has made Windsor the center of the shade grown tobacco industry. Because of its geographic location and its nearness to modern major highways that project in all directions, the town has attracted commercial and industrial establishments. In spite of the rapid growth, development has been controlled by means of modern zoning regulations. In general, permits have been granted subject to special conditions determined by subdivision regulations or the Planning and Zoning Commissions. The town has the power to adopt additional flood plain ordinances according to authority conferred by Chapter

124 of the General Statutes, as amended. Encroachment lines have been established in Windsor by the Connecticut Water Resources Commission. These are authorized by the General Assembly as section 25-4a to 4g of the General Statutes of the state of Connecticut. The purpose of this legislation is to prevent encroachment that will interfere with the passage of flood water in the river, without which new restrictions could form, thereby increasing the potential for flood damage upstream.

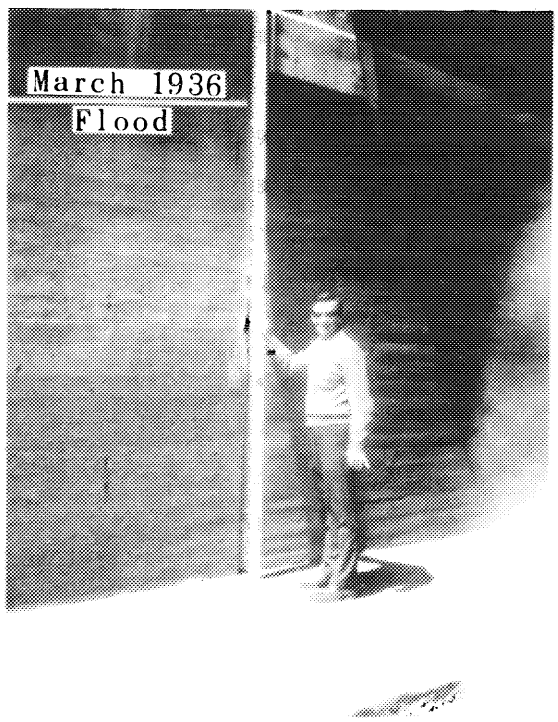
The Corps of Engineers has been collecting information for many years on existing and prospective flood conditions and hazards in the vicinity of Windsor, Connecticut. Investigations were made following all of the floods that have occurred in the area since March 1936. The information such as high water marks has been obtained by interviewing local residents and making field investigations (see Figure 1). A search was also made of newspaper files and historical documents. Office studies have been made to supplement these data and to develop the flood profiles. From these sources, and gage records it has been possible to develop a history of the floods on the Connecticut and Farmington Rivers covering the past 300 years.

Flood Damage Prevention Measures

There are no existing, authorized, or proposed flood control or related measures in the study area. There is, however, flood plain zoning in the town which should be reviewed reflecting the results of this study.



Farmington River, Windsor, Conn.
Entrance to boiler room at Loomis
Institute on right bank



Flood heights, Route 5A(Palisado Ave.) underpass
at Railroad Bridge, Windsor, Conn.

FIGURE 1

Since 1936, the New England Division, Corps of Engineers has been active in a program of investigating the possibility of constructing flood control reservoirs in the various river basins in New England. Studies have been made on the Connecticut and Farmington Rivers and are being updated in the Connecticut River Comprehensive Survey. Plate 1 shows the location of the completed flood control dams which are also listed in Table 2. Thirteen dams have been completed upstream of Windsor on Connecticut River tributaries and three have been completed on the Farmington River and its tributaries. All estimates of future flooding show the benefits derived from these 16 flood control dams.

Flood Warning and Forecasting Services

The U.S. Department of Commerce, National Weather Service, is responsible for forecasting highwater on the nation's rivers and for issuing flood warnings for the protection of life and property. The National Weather Service Forecasting Center in Hartford, Connecticut is responsible for issuing flood warnings for the Connecticut and Farmington Rivers in Windsor. Because of the high concentration of population and the economic significance of the two valleys, the River Forecasting Center has put maximum effort into the development of forecast procedures for these rivers, and has here a greater network of rainfall and river stage reporting stations than

any other watershed of comparable size. A comprehensive network of rainfall and river data reporting stations has been established with cooperative observers. The flood warnings are issued by teletype simultaneously to the press services, State police, Civil Defense and many other state and local agencies. In the event of communication failure the State police and Civil Defense have an emergency plan for receiving flood warnings and notifying the responsible officials. Heeding a flood warning is of prime importance for the protection of life, health and property of the inhabitants in the flood plains in Windsor.

TABLE 2

COMPLETED FLOOD CONTROL DAMS

CONNECTICUT RIVER BASIN

Name	River and State	Drainage Area (sq. mi.)	Flood Control Storage (ac. ft.)	Status
Union Village	Ompompanoosuc, Vt.	126	38,000	Complete
North Hartland	Ottauquechee, Vt.	220	71,400	"
No. Springfield	Black, Vt.	158	50,600	"
Ball Mountain	West, Vt.	172	54,600	"
Townshend	West, Vt.	278	33,200	"
Surry Mountain	Ashuelot, N.H.	100	32,500	"
Otter Brook	Ashuelot (Otter Brook), N.H.	47	17,600	"
Birch Hill	Millers, Mass.	175	49,900	"
Tully	Millers (Tully), Mass.	50	22,000	"
Barre Falls	Chicopee (Ware), Mass.	55	24,000	"
Conant Brook	Chicopee (Conant Brook), Mass.	8	3,840	"
Knightville	Westfield, Mass.	164	49,000	"
Littleville	Westfield (Middle Br.), Mass.	52.3	23,600	"
Mad River	Farmington (Mad), Conn.	18.2	9,630	"
Colebrook River	Farmington (West Br.), Conn.	119	50,800	"
Sucker Brook	Farmington (Mad), Conn.	3.4	1,450	"

CONNECTICUT RIVER

The Stream and Its Valley

The Connecticut River basin shown on Plate 1 extends from the northernmost part of New Hampshire to Long Island Sound. It includes a small area of the Canadian Province of Quebec and portions of the states of Maine, New Hampshire, Vermont, Massachusetts and Connecticut. It is long and narrow in shape and is the largest river basin in New England. The maximum length in a north-south direction is about 280 miles, the maximum width, in central Massachusetts is about 62 miles and the total area is approximately 11,250 square miles. The drainage area at the Hartford gage just downstream of this study is 10,480 square miles.

The Connecticut River rises in Third Connecticut Lake in the mountainous semi-wilderness area of northern New Hampshire adjacent to the Canadian border. The river follows a general southerly course along the approximate centerline of its watershed for over 400 miles from the outlet of the lake, to its mouth on Long Island Sound at Lynde Point, Saybrook, Connecticut. The total fall in the river is about 2,190 feet. The steepest portion, averaging 30 feet per mile, occurs in the first 30 miles below the outlet of Third Connecticut Lake.

For the next 65 miles the drop is on the average of 3.5 feet per mile, however, for the next 30 miles the river falls on the average of 13 feet per mile. From mile 270 in the vicinity of Wells River, Vermont to the head of tidewater, eight miles above Hartford the fall averages slightly less than two feet per mile.

The topography of the Connecticut River basin varies from rugged mountains in the north to the 90-mile reach between Turners Falls, Massachusetts and Middletown, Connecticut where the river flows through a lowland section. It is in this flat area that Windsor, Connecticut is located. Further south the river leaves the lowland and cuts through the southern portion of the New England upland in a narrow valley to the sea. The entire basin of the Connecticut River, however, flows for most of its course; in a wide, open valley with well-defined flood plains.

The stretch of the Connecticut River included in this report from mile 54.9 to mile 62.1 is in a wide flat flood plain with a maximum width of approximately $1\frac{1}{2}$ miles and forms the eastern town limit of Windsor. Pertinent drainage areas of the Connecticut River are given in Table 3.

TABLE 3

DRAINAGE AREAS IN WATERSHED OF CONNECTICUT RIVER

Location	Mile Above Mouth	Drainage Area (sq. mi.) Tributary	Total
Mouth	0.0	-	11,250
Hartford Gage	52.0	-	10,480
Farmington River	57.7	609	9,849
Scantic	59.5	114	9,730
Thompsonville Gage	68.2	-	9,661

Developments in the Flood Plain

The flood plain on the Connecticut River for the reach covered by this report is shown on Plate 4. Because of the long history of flooding on this river, in the town of Windsor, very little development has taken place within the flood plain. Most of the area is devoted to agricultural and recreational purposes. However, developments in the southern part of the town and in other scattered locations along the Connecticut River have been built in the flood plain.

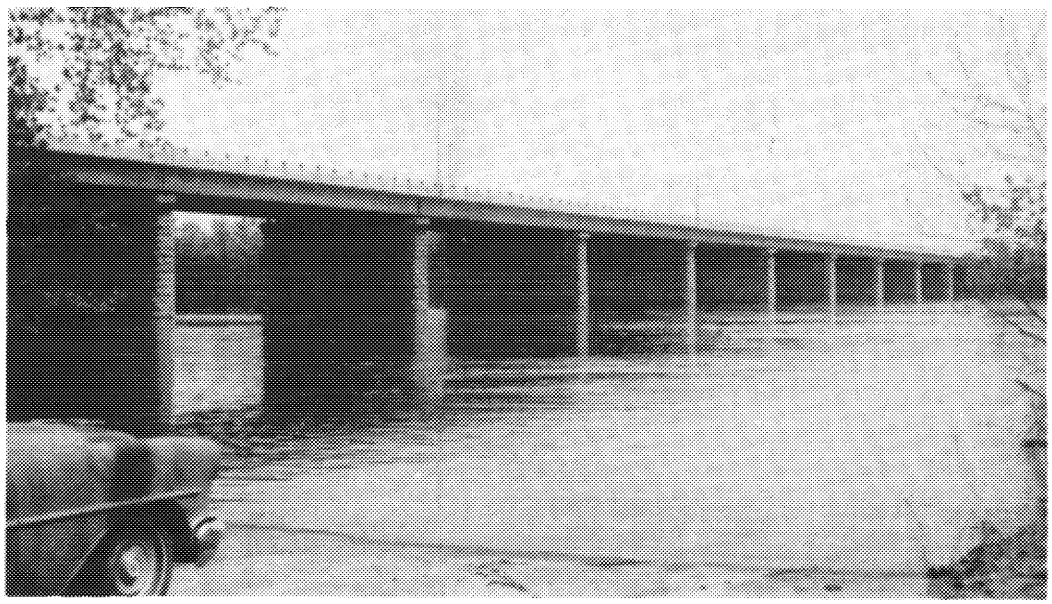
Bridges Across the Stream

The Captain John Bissel Bridge at mile 55.5 on the Connecticut River, Figure 2, is the only crossing of the river within the scope of this study.

This bridge is not a serious constriction to stream flows. It is a modern concrete structure, constructed in 1957 with a length of 1,677 feet in 14 spans at right angles to the river. The underclearance of this bridge is about 17 feet above the elevation of an Intermediate Regional Flood.

Flood Records

There is probably no region in New England where longer, more complete and more authentic records of previous floods are available than on the Connecticut River, especially in the lower portion of the basin. This area was first settled around 1633 and since then unusual events, such as great floods or freshets, have been described, often in considerable detail, in church records, diaries, letters, local histories and newspapers. Permanent marks made by interested parties have also furnished durable records of the heights reached by some notable early floods. From these sources the information relative to the occurrence of floods prior to the beginning of systematic records has been drawn. Records of river stages on the Connecticut River have been maintained since 1902 when the U.S. Department of Commerce Weather Bureau began observation of a gage on the downstream side of Bulkeley Bridge in Hartford, Connecticut (mile 52.0).



Captain John Bissel Bridge
Connecticut River, Windsor, Conn.
Looking upstream

FIGURE 2

The U. S. Geological Survey maintains many stream gaging stations on the Connecticut River. The nearest one, upstream of Windsor, is located in Thompsonville, Connecticut, just upstream of Enfield Dam (mile 68.2). These records have been kept since 1928.

Flood Stages

Information regarding stages of previous floods in the lower Connecticut River basin has been assembled by the U. S. Geological Survey and the Hartford office of the U. S. Weather Bureau from various sources. This information is too detailed and lengthy to be included in this report but is available for inspection at the Corps of Engineers, New England Division office.

Flood Occurrences

Since 1639 the Connecticut River has overflowed its banks in Windsor about 220 times. Of these about 145 have occurred due to excessive spring runoff caused by melting snow and warm rain during the months of March, April and May. Table 4 lists the crest elevations of the 10 highest floods at the Hartford gage that have occurred since the gage was installed. This points out that the greatest flood in Windsor and 5 others on the list occurred in March or April. Floods, however, have occurred in every month of the year. In the fall some of the flooding has been caused by heavy rains preceding and accompanying the tropical hurricanes that pass over southern New England. Two of these hurricanes caused the second and third highest floods in the area.

TABLE 4

CONNECTICUT RIVER, WINDSOR, CONNECTICUT

10 HIGHEST RECORDED FLOODS

Order No.	Date of Crest	Elevation (ft. m. s. l.)
1.	Mar 1936	38.5
2.	Sep 1938	36.6
3.	Aug 1955	33.2
4.	Nov 1927	30.5
5.	April 1960	29.3
6.	Mar 1913	27.8
7.	April 1933	27.5
8.	Jan 1949	26.9
9.	Mar 1953	26.5
10.	April 1909	26.2

Duration and Rate of Rise

Plate 3 are flood hydrographs on the Connecticut River at the U.S. Weather Bureau gage at Bulkeley Bridge in Hartford, Connecticut for the floods of March 1936, September 1938 and August 1955. These hydrographs would have approximately the same hydraulic characteristics at Windsor and are the three highest floods recorded in the area. They are classified as floods caused by three different types of storms and prior conditions. The following is a brief description of each storm which is also described in more detail in subsequent paragraphs.

March 1936 - Long period of warm spring rain augmented by melting snow in the upper part of the basin.

September 1938 - Long period of rain in upper part of basin followed by a tropical hurricane which went up the Connecticut River Valley.

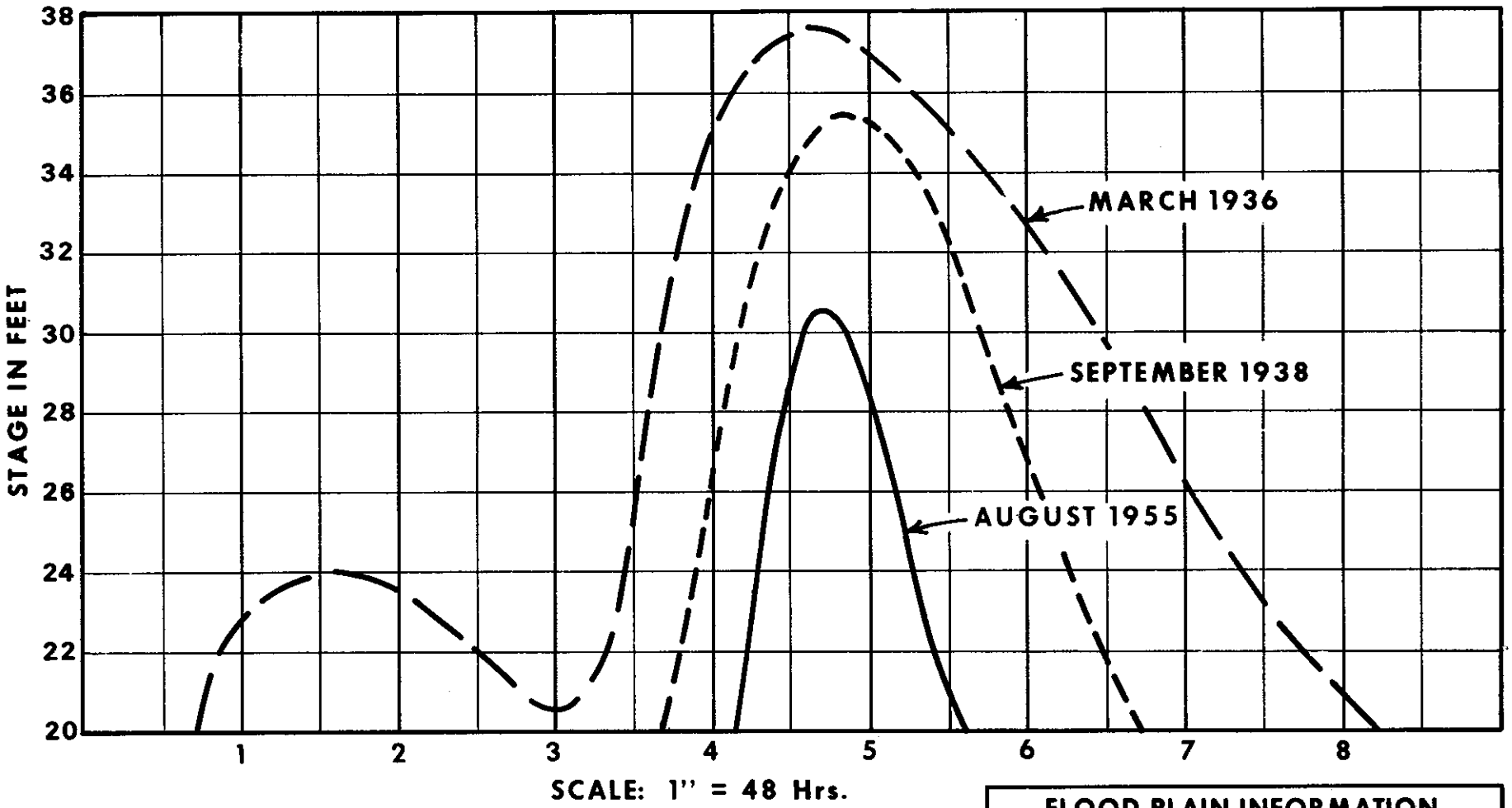
August 1955 - Rain brought in by a hurricane which only affected the lower portion of the basin.

The records show that the rate of rise of flood water from the three different types of storms is about the same or about 4 inches per hour. The rate of fall, however, varies with the type of storm. A flood caused by a lower basin storm (August 1955) will flow off at

the rate of about 3 inches per hour. An upper basin storm (September 1938) followed by a hurricane creates a flood which will fall at the rate of $2\frac{1}{2}$ inches per hour. The flood caused by warm rain on a heavy snow cover in the upper portion of the basin (March 1936) will take a long period to run off and will recede at the rate of about 1 inch per hour. The duration of flooding of the Connecticut River in Windsor depends almost entirely on the antecedent conditions and the location of the storm.

Flooded Areas and Flood Profiles

Plate 4 shows the approximate areas along Connecticut River in the vicinity of Windsor that would be inundated by the Intermediate Regional Flood (same as experienced flood of November 1927) and the Standard Project Flood (same as experienced March 1936 flood). The actual limits of these overflow areas on the ground may vary some from those shown on the maps because the 10 foot contour interval and scale of the map do not permit precise plotting of the flooded area boundaries. Plate 5 shows the high water profile for the flood of March 1936 modified by the flood control reservoirs. Also shown are the profiles for the Intermediate Regional Flood (same as experienced November 1927 flood) and the Standard Project Flood (same as experienced March 1936 flood).



FLOOD PLAIN INFORMATION
CONNECTICUT RIVER
AT HARTFORD, CONN.

FLOOD HYDROGRAPHS

AT U. S. W. B. GAGE - RIVER MILE 52.0

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

PLATE NO. 3

Flood Descriptions

The following are descriptions of the storms that created the three largest floods in the vicinity of Windsor. These are based upon newspaper accounts, historical records and field investigations.

March 1936

The stage was set for this flood in the fall of 1935. At this time, before there was a cover of snow, cold weather had frozen the ground and it remained frozen throughout the winter. Starting on the 9th of March, four distinct storm centers passed over the northern part of New England. The first was in the form of snow but on the 13th a disturbance moving northeastward merged with one from the west and distributed heavy precipitation over the entire northeast. The center of maximum rainfall was in the White Mountain area of New Hampshire. On 17 and 18 March another storm swept up the Connecticut Valley. Although the heaviest rain was centered over the White Mountains other parts of central New England had readings exceeding 4 or 5 inches. A fourth disturbance was accompanied by minor rainfall between the 20th and 22nd.

Consideration must also be given to the fact that the first heavy rain fell on snow upward to a depth of 43 inches with a water content of up to 12 inches. The rainfall records of this storm have been ex-

ceeded many times but because the rain occurred so early in the year and fell on deep saturated snow, the aggregate amount of water in the runoff has never been equaled.

The flood resulting from the first storm was accompanied by the breaking up of the heavy ice on the streams. This ice was thicker and stronger than that usually found at times of the spring break-up. At Windsor the ice had an average thickness of 15 inches just before the first flood. Great ice jams formed downstream of Windsor and the water backed up to elevations equal to the flood of November 1927. As the ice jams broke, lakes and ponds upstream began releasing large volumes of water and a week later the flood waters at Windsor rose to elevations that have never been equaled.

September 1938

Flooding caused by a series of storms in September 1938 is commonly associated with the tropical hurricane which swept up the Connecticut Valley on 21 September. It appears, however, that this tropical disturbance had little affect on the major flooding that occurred.

Light rain started in the Windsor area on 12 September and continued intermittently until the 16th, thoroughly saturating the ground. On the 17th, heavier rains started and continued until the 21st. The

heaviest downfall occurred on the 20th when records show that 6.1 inches fell in 24 hours and 1.33 inches were measured in 1 hour. It was not until about 4 p.m. on the 21st that the center of the hurricane passed over the area. Records show that in the 5 days preceding the hurricane as much as 17 inches of rain fell in the vicinity of Windsor.

The river started to rise as the rain fell but it was not until the afternoon of the 23rd when the river crested. Even though the total rainfall in Windsor far exceeded that of March 1936, the flood elevations were less. This was because the center of the 1936 storm occurred in the upper reaches of the basin, and were augmented by melting snow and produced a runoff that had to flow down the Connecticut River past Windsor in its entirety.

August 1955

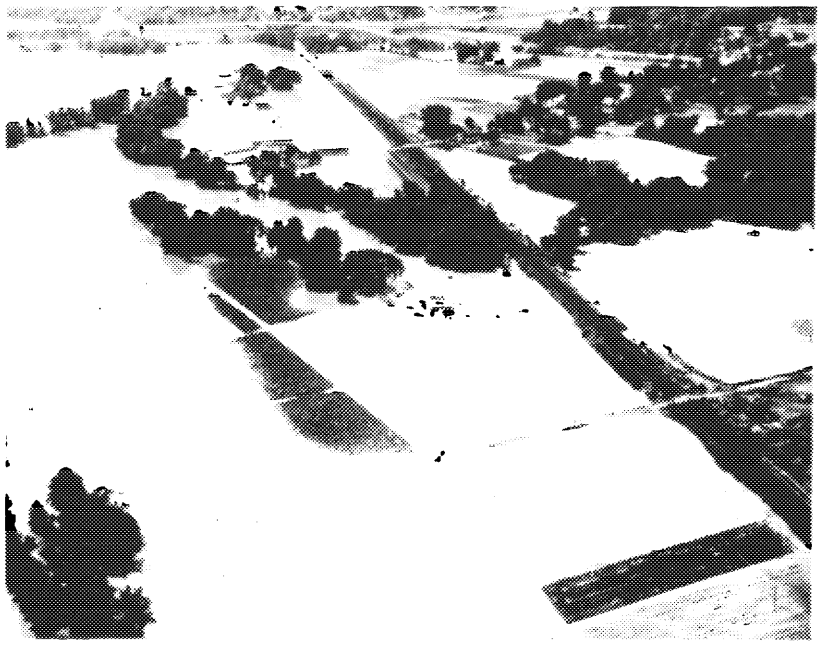
Even though the residents of Windsor remember the August 1955 storm as one that caused disastrous flooding, it still only caused flood elevations about 5 feet lower than that of March 1936.

Two major storms with hurricane winds occurred in August 1955. The first, named "Connie", skirted the coast of Virginia on its way north and then veered to the northwest leaving the United States at the

western corner of New York State. Even though the center of the storm was far west of Connecticut, it did drop 5 to 7 inches of rain on land that had just been through a hot, dry summer. Because of the absorbent condition of the soil, most of this water was sucked into the ground, but it did leave the soil well saturated.

A week later, hurricane "Diane" traveled north to New Jersey and then turned sharply to the east touching the south shore of Long Island and Cape Cod. The wind effect of this hurricane was minor but the amount of rainfall was outstanding. Close to 20 inches of rain fell in areas just north of Windsor. Flooding developed quickly because of the heavy rain and because the soil was still wet from previous storms.

The high intensity of rain that fell during this torm could have caused much more severe flooding. The storm was traveling in a west to east direction and quickly passed over the main stream at a right angle. If the storm had suddenly veered to the north over Connecticut the floods would have been much greater. (See Figure 3.)



Flood scene in Windsor, Conn. August 1955 Flood
Looking south towards Hartford Dike

FIGURE 3

FARMINGTON RIVER

The Stream and Its Valley

The Farmington River basin as shown on Plate 2 is about 46 miles long in the north-south direction and about 29 miles wide in the east-west direction. However, its actual water course is more than 80 miles long as it meanders from its source in Becket, Massachusetts to its mouth at Windsor, Connecticut. The main channel from Becket to New Hartford, Connecticut, a distance of about 35 miles is identified as the West Branch of the Farmington River. As the West Branch flows in a southerly direction, the average fall in the river represents a slope of about 40 feet per mile. This slope does not reflect the true hydraulic gradient since some of the fall takes place at dams.

At New Hartford, the Farmington River is formed by the joining of the West Branch and the highly regulated East Branch. From this junction the river continues in a southeasterly direction for a distance of about 15 miles to the River Glen section of the town of Farmington, Connecticut. In this reach of river the main channel has an average slope of about 12 feet per mile.

Just downstream of River Glen at the mouth of the Pequabuck River, the Farmington turns almost 90 degress into a northerly direction. For the next 20 miles, the river flows almost due north

to the Tariffville section of the town of Simsbury. In this reach of river the valley broadens into a wide, flat flood plain approximately one-half mile wide with an average channel slope of less than 1 foot per mile. Due to the flat gradient and the wide flood plain, this portion of the Farmington River Valley becomes a natural flood control reservoir during times of flood and has proved very beneficial to the downstream community of Windsor and other areas along the Connecticut River.

In the 13 miles from Tariffville to where it joins the Connecticut River in Windsor, the Farmington River channel drops about 125 feet. However, about 70 percent of this fall takes place at the Tariffville gorge and the power dam at Rainbow, Connecticut.

The general characteristics of the drainage in the entire basin are the narrow tributary watersheds with sharply rising hills and steep channel slopes. The steep slopes and short flashy streams are conducive to rapid runoff. The small lakes, ponds and swampy areas in the tributary watersheds have little or no effect on major floods.

On the Farmington River upstream of the community of Rainbow the elevation of the river is controlled by the Farmington River Power Company Dam, and the flood plain does not extend beyond the river banks. Downstream from the dam the river flows through the community of Poquonock where the valley widens out into the Connec-

ticut River lowlands. The stretch of the Farmington River included in this report from the confluence with the Connecticut River to the Windsor-Bloomfield town line is in a wide flat flood plain with a maximum width of approximately 1/2 mile.

The following is a summary of drainage areas in the Farmington River basin pertinent to this study:

TABLE 5

DRAINAGE AREAS IN FARMINGTON RIVER WATERSHED

Location	Drainage Area in Square Miles
Farmington River:	
at River Glen railroad bridge	388
at Tariffville gorge	578
at Rainbow (USGA gage)	591
at mouth	602
Pequabuck River at mouth	58.4
Salmon Brook at mouth	67.3

Development in the Flood Plains

The flood plain on the Farmington River for the reach covered by this report is shown on Plate 6. Very little development has taken place within the flood plain, because of its long history of flooding. Most of the flood plain is devoted to agriculture. However, some development has taken place in low scattered areas.

Bridges Across the Stream

Three highway bridges and one railroad bridge cross Farmington River in the reach included in this study. Table 6 lists pertinent elevations for these structures and shows their relation to the Intermediate Regional Flood. Figures 4 and 5 show photographs of the bridges.

The Palisado Avenue Bridge (Route 5A) and the railroad bridge just upstream on the Farmington River are the only bridges that will cause any obstructions to the flow of the river. This will be slight because of the wide flood plains over which the floods will flow.

Dams on the Farmington River

Only one dam has been constructed in the reach on the Farmington River covered by this report. This dam is owned and operated by the Farmington River Power Company. It is about 47 feet high and has a top elevation of 92.3 feet m.s.l. without flashboards: with flashboards 6 feet is added to the height. Figure 6 is a photo of the dam and the power plant.

Obstructions to Flood Flow

No significant obstructions to flows exist other than those just described in previous paragraphs.

TABLE 6

BRIDGES ACROSS FARMINGTON RIVER

Mouth	Identification	Normal River Flow ft. msl	Floor Elev. ft. msl	Intermediate Regional Flood Crest ft. msl	Standard Project Flood Crest ft. msl	Elev. ft. msl	Underclearance Relation to Intermediate Regional Flood Above feet	Underclearance Relation to Intermediate Regional Flood Below feet
1.3	Palisado Ave. (Route 5A)	4.2	33.9	31.8	38.8	30.7	---	1.17
1.5	R. R.	4.2	40.5	31.9	38.9	32.9	1.0	---
3.9	Route 91	7.8	51.7	32.9	39.6	46.2	13.3	---
6.6	Route 75	29.5	64.6	40.2	51.8	52.6	12.4	---

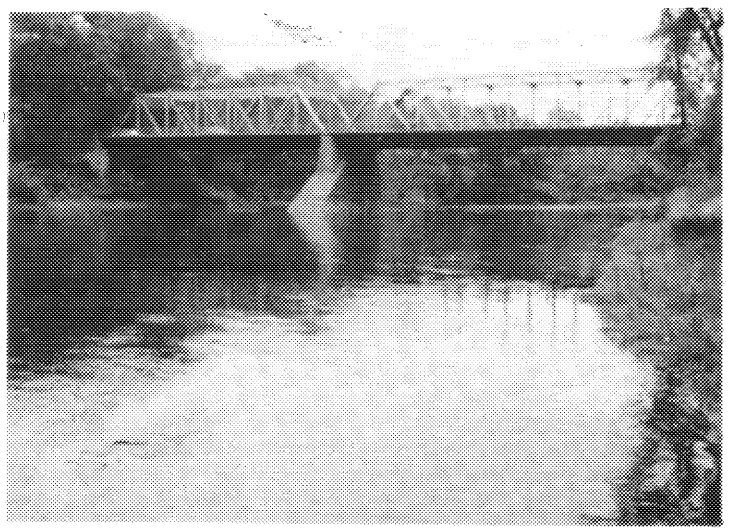
Flood Records

There are many gaging stations in the Farmington River basin. Most of these are maintained and read by the U. S. Geological Survey, Some are read by the Metropolitan District Commission, Hartford and one by the Board of Water Commissioners, New Britain. During periods of high water many additional miscellaneous sites are used to record a complete story of flood conditions. A U. S. Geological Survey Gaging Station is located within the study area. This station is located in the community of Rainbow in Windsor on the left bank and about 0. 4 miles downstream from Farmington River Power Company Dam. It has a drainage area of 584 square miles and was first established in 1928.

The records from this gage were augmented by high water data collected and published after all the floods that have occurred in recent times. This information was supplemented by local records as well as from interviews with local residents.

Flood Stages and Discharges

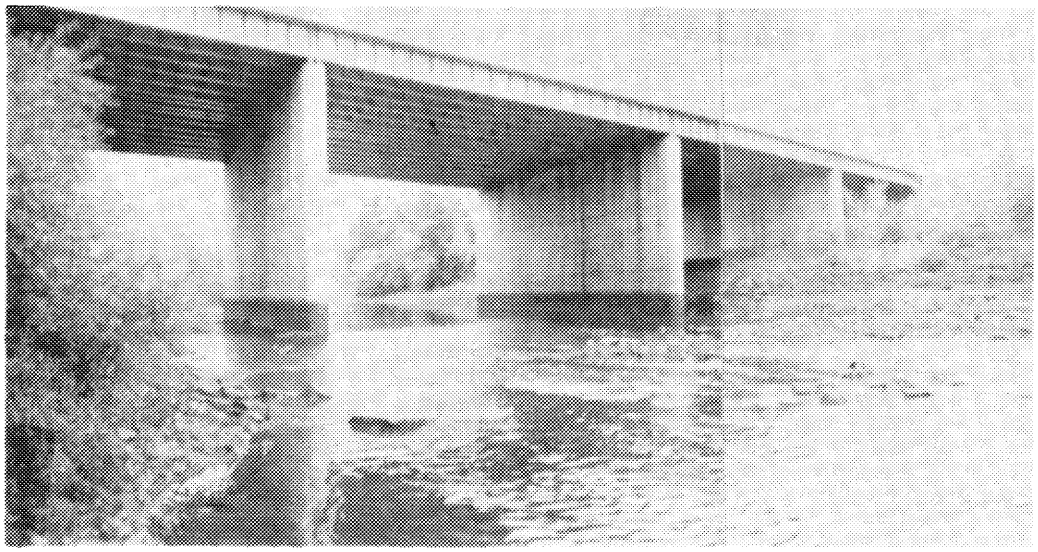
A stage-discharge relationship cannot be transposed from the USGS gaging station site to the flat flood plains downstream as flooding in this area is caused primarily by backwater from the



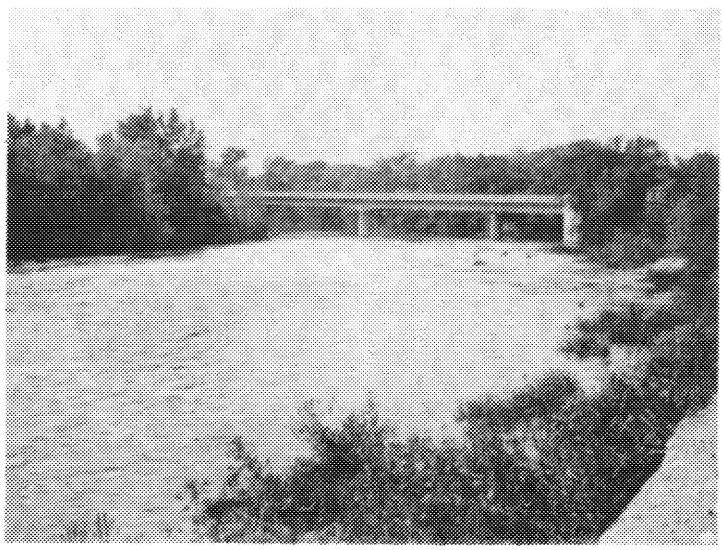
Palisado Avenue Bridge,
Farmington River , Windsor , Conn.
Looking downstream

Railroad Bridge
Farmington River, Windsor, Conn.
Looking upstream

FIGURE 4

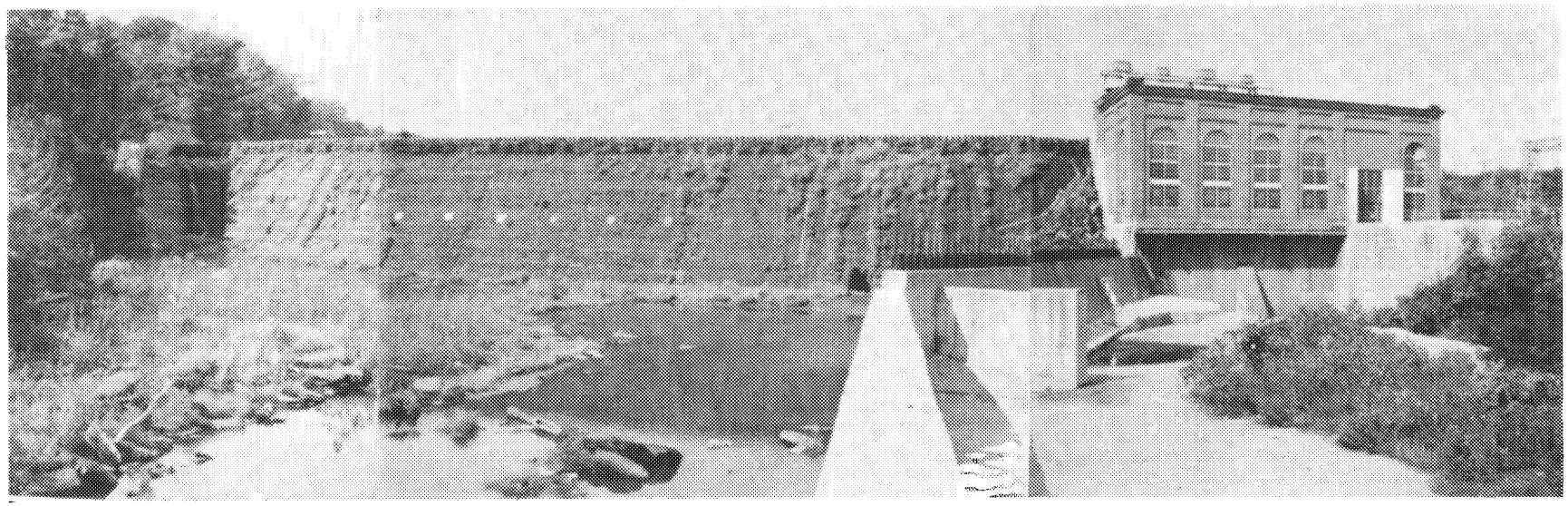


Route I-91 Bridge, Farmington River, Windsor, Conn.
Looking downstream



Route 75 Bridge, Farmington River, Windsor, Conn.
Looking upstream

FIGURE 5



Rainbow Dam, Farmington River, Windsor, Connecticut

FIGURE 6

Connecticut River. The flow of water on the Farmington River does however contribute greatly to the severe flooding conditions in Windsor. Table 7 lists the peak flows at the Rainbow gaging station.

TABLE 7

FLOODS IN ORDER OF MAGNITUDE

U.S. GEOLOGICAL SURVEY GAGING STATION

FARMINGTON RIVER, RAINBOW, CONNECTICUT

No.	Date of Crest	Elevation ft. msl	Estimated Peak Discharge cfs
1	August 19, 1955	58.86	69,200
2	October 16, 1955	51.71	34,700
3	September 22, 1938	49.36	29,900
4	March 19, 1936	48.76	26,900
5	January 1, 1949	49.19	26,550

Flooded Areas and Flood Profiles

Plate 6 shows the approximate areas along the Farmington River in the vicinity of Windsor that would be inundated by the Intermediate Regional Flood and the Standard Project Flood. The actual limits of these overflow areas on the ground may vary some from those shown on the maps because the 10 foot contour interval and the scale

of the map do not permit precise plotting of the flood area boundaries. Plates 7 and 8 show the high water profiles for the Intermediate Regional Flood and the Standard Project Flood.

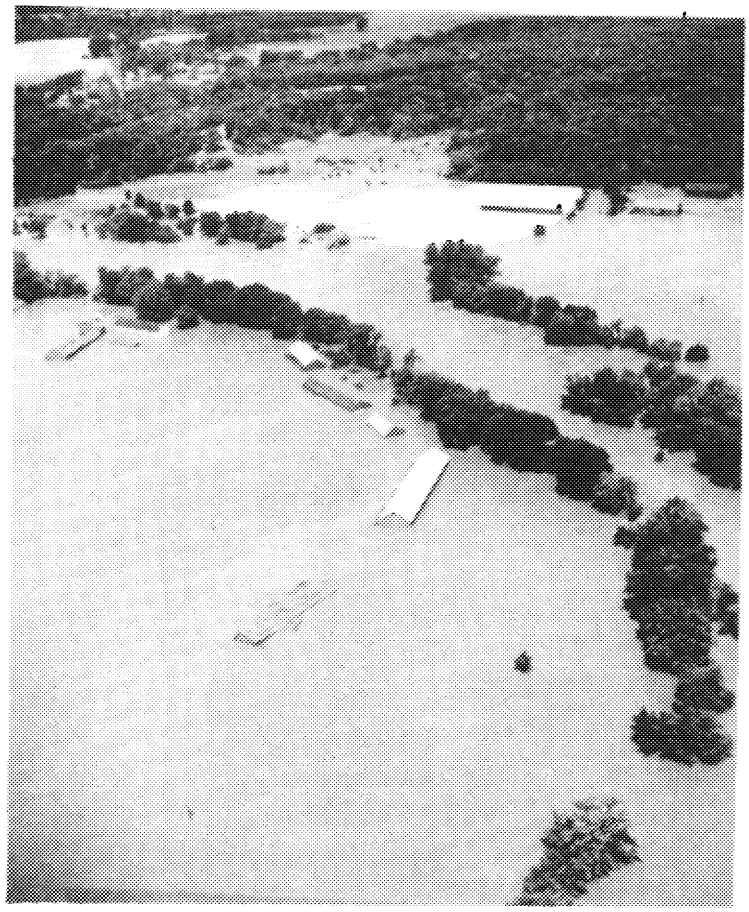
Flood Descriptions

General descriptions of large floods on the Farmington River are included with the discussion of past floods on the Connecticut River. Figure 7 shows a flood scene during the March 1936 flood from the railroad bridge over Palisado Avenue looking toward bridge over Farmington River and the lower picture was taken from the same location one year later. Figure 8 is a flood scene of the Farmington River taken in August 1955 about 1/2 mile downstream from Route 75 bridge in the village of Poquonock.

Palisado Avenue, Windsor, Conn.
The upper view is from Railroad Bridge, looking towards Bridge over Farmington River during March 1936 Flood.

Lower picture was taken from same location, one year later.

FIGURE 7



Flood scene in Windsor, Conn.
August 1955 Flooding of Farmington River
One-half mile downstream from Route 75 Bridge
Looking north

FIGURE 8

FUTURE FLOODS

This section of the report discusses the Standard Project Flood and the Intermediate Regional Flood and some of the hazards of these great floods on the Connecticut and Farmington Rivers in the vicinity of Windsor, Connecticut. Floods of the size of the Standard Project Flood represent reasonable upper limits of expected flooding. This is with the realization that 16 flood control dams upstream of Windsor are in operation at the time of this flood. It is noted that floods of this magnitude actually did occur prior to the construction of the flood reservoirs. Those of the size of the Intermediate Regional Flood represent floods that may reasonably be expected to occur more frequently, although they will not be as high as the infrequent Standard Project Flood.

Large floods have been experienced in the past on streams in the general geographical and physiographical region of Windsor. Heavy storms similar to those causing these floods would occur over the watershed of the Connecticut and Farmington Rivers. In this event, floods would result on these streams comparable in size with those experienced on neighboring streams. It is therefore desirable, in connection with any determination of future floods which may occur

on the Connecticut and Farmington Rivers, to consider storms and floods that have occurred in the region on watersheds, whose topography, watershed cover, and physical characteristics are similar to those of these two streams.

DETERMINATION OF INTERMEDIATE REGIONAL FLOOD

The Intermediate Regional Flood is defined as a flood having an average frequency of occurrence in the order of once in 100 years at a designated location, but the flood may occur at any time. For this reason, the Intermediate Regional Flood is better described as a flood with a 1% chance of occurring each year. The Intermediate Regional Flood represents a major flood but much less severe than the Standard Project Flood.

In order to determine the Intermediate Regional Flood for the Connecticut and Farmington Rivers, statistical studies were made using the more than 300 year record of known flood data in the area. Table 1 lists the maximum known discharges that have occurred at this location.

Results of this study indicate that the Intermediate Regional Flood on the Connecticut River would reach about the same elevation as the November 1927 flood. It would also be about three feet lower

than the August 1955 flood, about six feet lower than the flood of September 1938 and about 8 feet lower than the maximum flood of March 1936. The analyses also show that the Intermediate Regional Flood on the Connecticut River would have a peak discharge of 176,000 cubic feet per second at the confluence of the Farmington River.

Upstream on the Farmington River but below Rainbow Dam the Intermediate Regional Flood would be about 8 feet lower than the maximum flood of August 1955 and would be about the same elevation as the experienced 1938, 1936 and 1948 floods. Above Rainbow Dam the Intermediate Regional Flood would be about one foot lower than the maximum flood of 1955, one foot higher than the 1936 flood and two feet higher than the flood of 1948.

These analyses also show that the Intermediate Regional Flood would be much higher if it were not for the fact that at least 16 flood control dams in the Connecticut River basin will be in operation at the time of this flood.

DETERMINATION OF STANDARD PROJECT FLOODS

The largest flood that is likely to occur on a specific stream has been experienced only in rare instances. It is an accepted fact that, as severe as the maximum known flood may have been, sooner or later a larger flood can and probably will occur. The Corps of Engineers, in cooperation with the Weather Bureau, has made broad and comprehensive studies and investigations based on the vast records of experienced storms and floods and has evolved generalized procedures for estimating the flood potential of streams. These procedures have been used in determining the Standard Project Flood. It is defined as the largest flood that can be expected from the most severe combination of meteorological and hydrological conditions that are considered reasonable characteristics of the geographical region involved.

A Standard Project Flood has been estimated for the Connecticut and Farmington Rivers. The analyses indicate the Standard Project Flood on the Connecticut River would reach about the same elevation as the March 1936 flood and would also be about five feet higher than the August 1955 flood. The peak discharge for this flood at the confluence of the Farmington River would be about 313,000 cubic feet per second.

The Standard Project Flood on the Farmington River up to Rainbow Dam would reach about the same elevations as the August 1955 flood and would be about 8 feet higher than the 1938, 1936, 1927 floods. Above Rainbow Dam, the Standard Project Flood would be about the same as the August 1955 flood and two feet higher than the flood of March 1936. This flood is modified by the benefits from at least 16 flood control dams in the Connecticut River basin. Much higher elevations would be experienced if they were not in operation.

Frequency

It is not practical to assign a frequency to the Standard Project Flood. The occurrence of such a flood would be a rare event, however, it could occur in any year.

Possible Larger Floods

Floods larger than the Standard Project Flood are possible, however, the combination of factors that would be necessary to produce such floods would seldom occur. However, the consideration of floods of this magnitude should not be overlooked in the study of any problem.

HAZARDS OF GREAT FLOODS

The amount of damage caused by any flood depends upon how much area is flooded and the height of flooding.

Areas Flooded and Heights of Flooding

The areas along the Connecticut and Farmington Rivers flooded by the Standard Project Flood (maximum experienced flood) and the Intermediate Regional Flood are shown on Plates 4 and 6. Depth of water of these two floods and also the maximum known flood modified by 16 flood control floods can be determined from the profiles which are shown on Plates 5, 7 and 8.

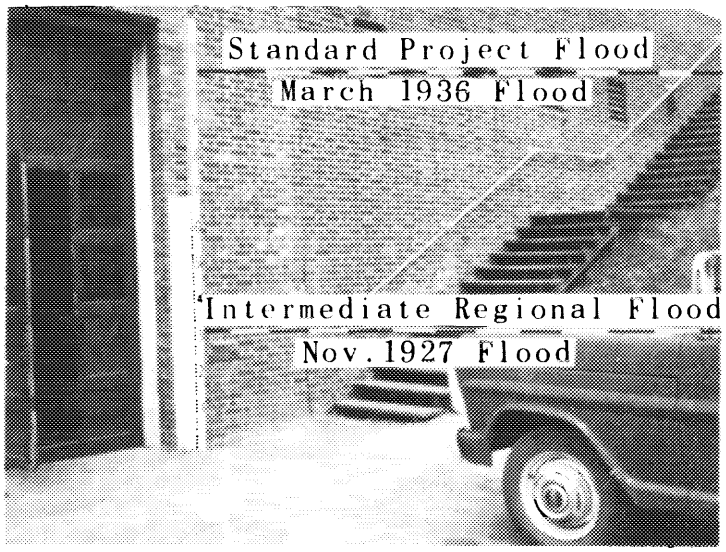
The profiles for the two rivers were computed by using river characteristics for selected reaches as determined from flow records, topographic maps and valley cross sections. The overflow areas and the elevations shown on Plates 4 through 8 have been determined with an accuracy consistent with the purposes of this study and the accuracy of the basic data.

The profiles of the Standard Project Flood and the Intermediate Regional Flood depend in part upon the degree of destruction on clogging of the various bridges during the flood. Because it is impossible to forecast these events, it was assumed that all bridge structures would stand and that no clogging would occur.

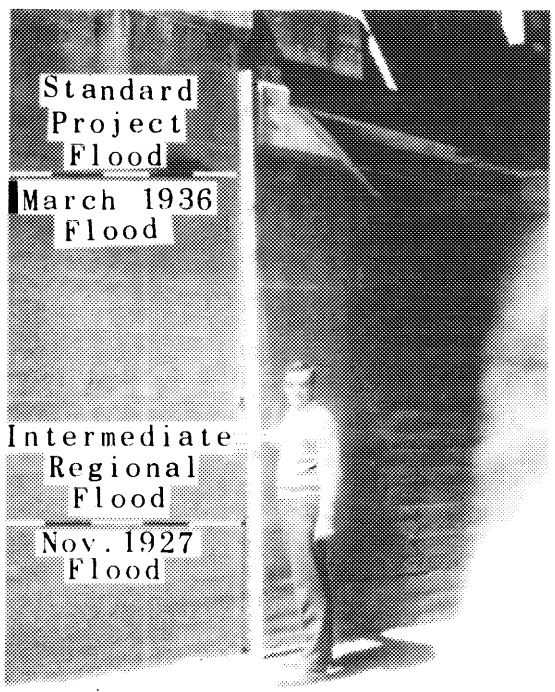
The Standard Project Flood profile for Connecticut River is about 5 feet higher than the August 1955 flood. Because of the wide flood plain, the increase in depth of flooding is uniform for the limits of the study. The Standard Project Flood profile for Farmington River is from 0 to 5 feet higher than the August 1955 flood. The maximum difference occurs at the downstream end of the river due to backwater from Connecticut River. Upstream on the Farmington River where backwater from the Connecticut River has no influence on the flooding, the Standard Project Flood is considered to be the same as the August 1955 flood.

The Intermediate Regional Flood profile for Connecticut River is about 2 feet lower than the August 1955 flood. This difference is also uniform in the limits of the study area because of the wide flood plain. The Intermediate Regional Flood profile for Farmington River is from 2 to 11 feet lower than the August 1955 flood up to Rainbow Dam and 1 foot lower than the August 1955 flood above the dam. The maximum difference occurs downstream from the dam in the vicinity of Route 75 bridge. This is upstream of the area influenced by backwater from the Connecticut River but because of the narrow valley the August 1955 flood water reached abnormal heights.

Figures 9 and 10 show the heights that would be reached by the Standard Project Flood and the Intermediate Regional Flood on facilities presently existing within the flood plains in the vicinity of Windsor.

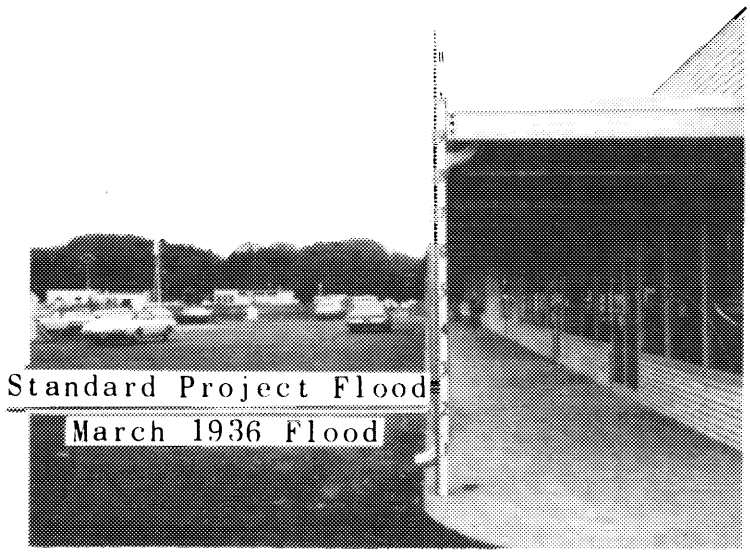


Flood heights, Boiler Room
Loomis School, Windsor, Conn.



Flood heights, Route 5A underpass
at Railroad Bridge, Windsor, Conn.

FIGURE 9



Flood heights at Wilson Shopping Center
Meadow Road, Windsor, Conn.

FIGURE 10

GLOSSARY OF TERMS

Flood

An overflow of water onto lands not normally covered by water and that are used or usable by man. Floods have two essential characteristics: the inundation of land is temporary; and the land is adjacent to and inundated by overflow from a river or stream or an ocean, lake, or other body of standing water.

Normally, a "flood" is considered as any temporary rise in stream flow or stage, but not the ponding of surface water that results in significant adverse effects in the vicinity. Adverse effects may include damages from overflow of land areas, temporary backwater effects of sewers and local drainage channels, creation of unsanitary conditions or other unfavorable situations by deposition of materials in stream channels during flood recessions, rise of ground water coincident with increased stream flow, and other problems.

Flood Crest

The maximum stage or elevation reached by the waters of a flood at a given location.

Flood Peak

The maximum instantaneous discharge of a flood at a given location. It usually occurs at or near the time of the flood crest.

Flood Plain

The relatively flat area or low lands adjoining the channel of a river stream or watercourse or ocean, lake, or other body of standing water, which has been or may be covered by flood water.

Flood Profile

A graph showing the relationship of water surface elevation to location, the latter generally expressed as distance above mouth for a stream of water flowing in an open channel. It is generally drawn to show surface elevation for the crest of a specific flood, but may be prepared for conditions at a given time or stage.

Flood Stage

The stage or elevation at which overflow of the natural banks of a stream or body of water begins in the reach or area in which the elevation is measured.

Head Loss

The effect of obstructions, such as narrow bridge openings or buildings that limit the area through which water must flow, raising the surface of the water upstream from the obstruction.

Intermediate Regional Flood

A flood having an average frequency of occurrence in the order of once in 100 years although the flood may occur in any year. It is based on statistical analyses of stream flow records available for the watershed and analyses of rainfall and runoff characteristics in the "general region of the watershed".

Left Bank

The bank on the left side of a river, stream, or watercourse, looking downstream.

Low Steel (or Underclearance)

See "underclearance".

Right Bank

The bank on the right side of a river, stream, or watercourse, looking downstream.

Standard Project Flood

The flood that may be expected from the more severe combination of meteorological and hydrological conditions that are considered reasonably characteristic of the geographical area in which the drainage basin is located, excluding extremely rare combinations. Peak discharges for these floods are generally about 40% to 60% of

the Probable Maximum Floods for the same basins. Such floods, as used by the Corps of Engineers, are intended as practicable expressions of the degree of protection that should be sought in the design of flood control works, the failure of which might be disastrous.

Underclearance

The lowest point of a bridge or other structure over or across a river, stream, or watercourse that limits the opening through which water flows. This is referred to as "low steel" in some regions.

AUTHORITY, ACKNOWLEDGEMENTS, AND AVAILABLE ASSISTANCE

This report has been prepared in accordance with the authority granted by Section 206 of the Flood Control Act of 1960 (P. L. 86-645) as amended.

* * *

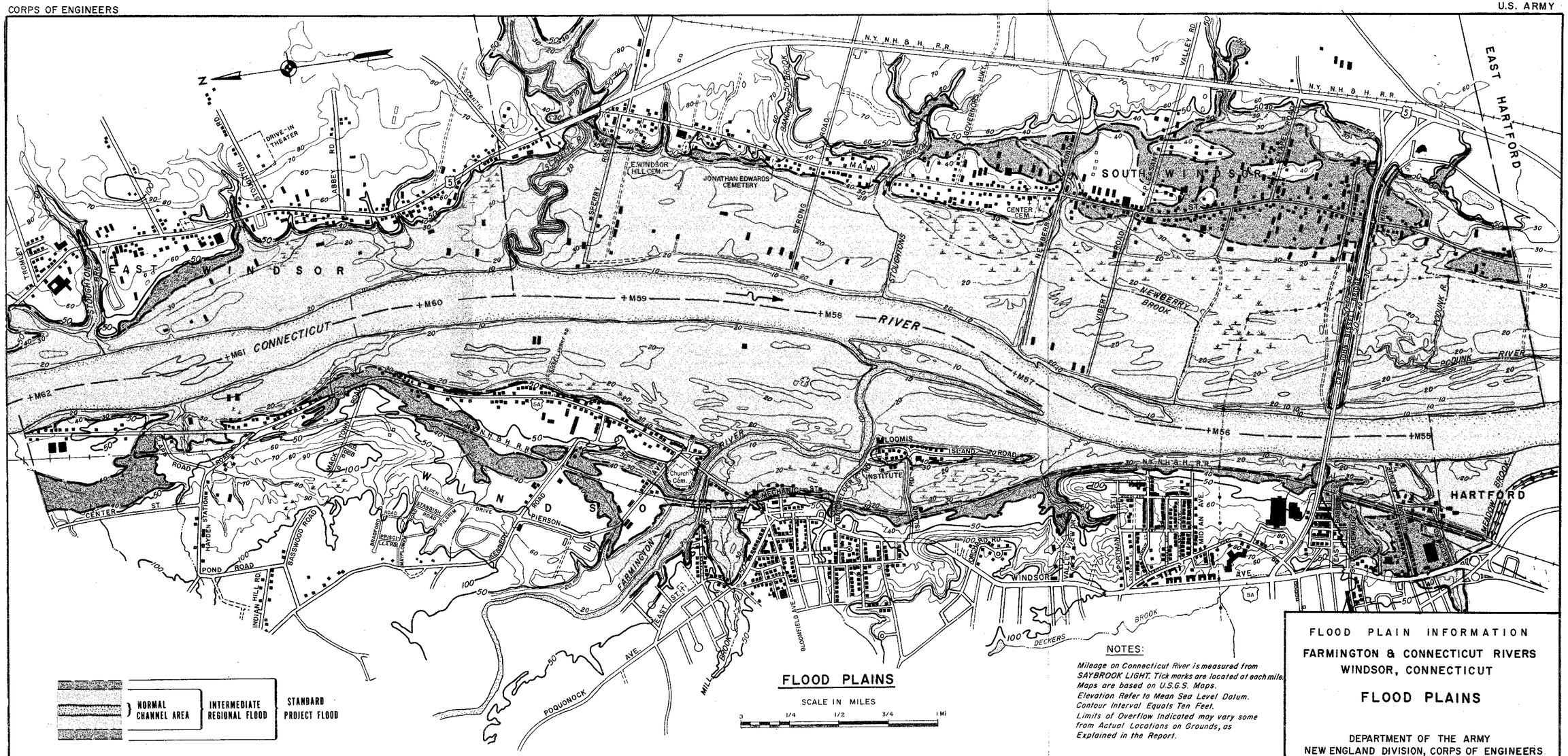
Assistance and cooperation of the U.S. Weather Bureau, U.S. Geological Survey, Connecticut Water Resources Commission, Connecticut Highway Department, town of Windsor and private citizens in supplying useful data are appreciated.

* * *

This report presents the local flood situation for Windsor. The New England Division of the Corps of Engineers will provide technical assistance in application of data presented herein.

CORPS OF ENGINEERS

U.S. ARMY



NORMAL CHANNEL AREA | INTERMEDIATE REGIONAL FLOOD | STANDARD PROJECT FLOOD

FLOOD PLAINS

SCALE IN MILES

0 1/4 1/2 3/4 1 Mi

NOTES:

Mileage on Connecticut River is measured from SAYBROOK LIGHT. Tick marks are located at each mile.
Maps are based on U.S.G.S. Maps.
Elevation Refer to Mean Sea Level Datum.
Contour Interval Equals Ten Feet.
Limits of Overflow Indicated may vary some from Actual Locations on Grounds, as Explained in the Report.

FLOOD PLAIN INFORMATION

FARMINGTON & CONNECTICUT RIVERS
WINDSOR, CONNECTICUT

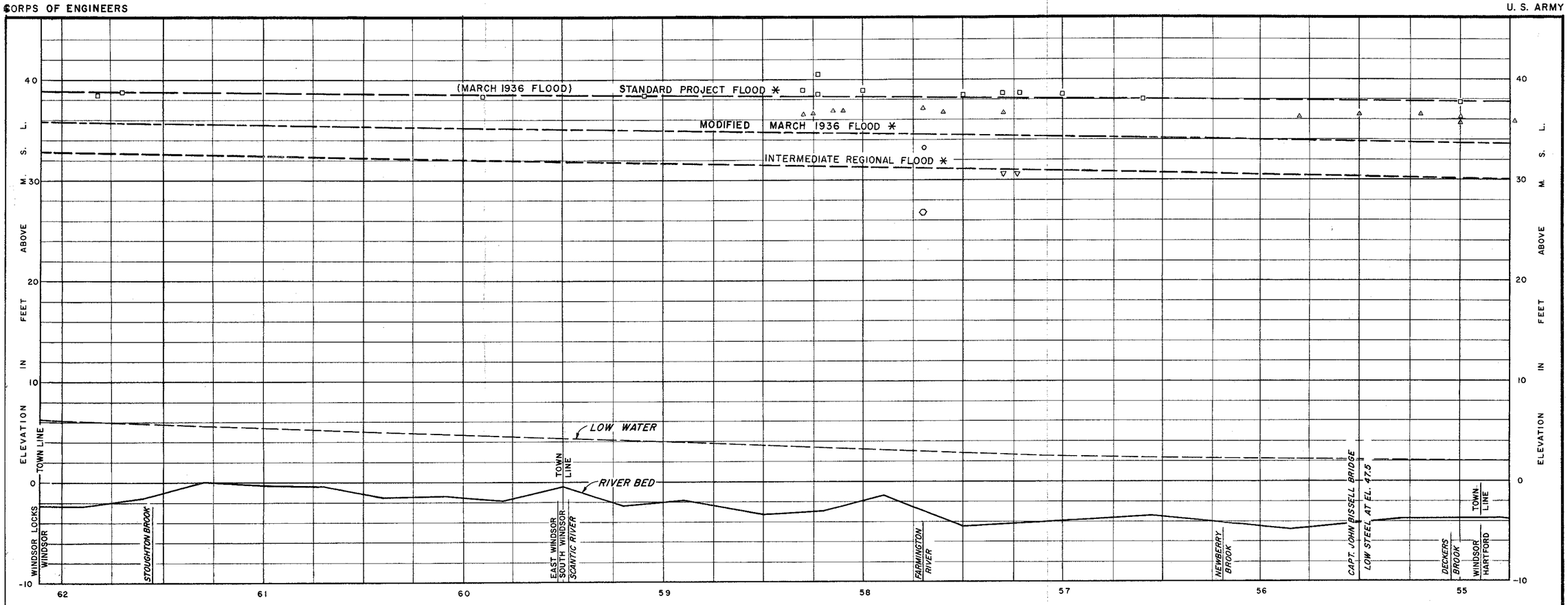
FLOOD PLAINS

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

PLATE NO. 4

CORPS OF ENGINEERS

U. S. ARMY



NOTE:

*Profile based on flood control dams inoperation (see report)

HIGH WATER MARKS

□	MARCH	1936	FLOOD
△	SEPTEMBER	1938	FLOOD
○	AUGUST	1955	FLOOD
▽	NOVEMBER	1927	FLOOD
⬡	DECEMBER	1948	

FLOOD PLAIN INFORMATION

CONNECTICUT RIVER

WINDSOR, CONNECTICUT

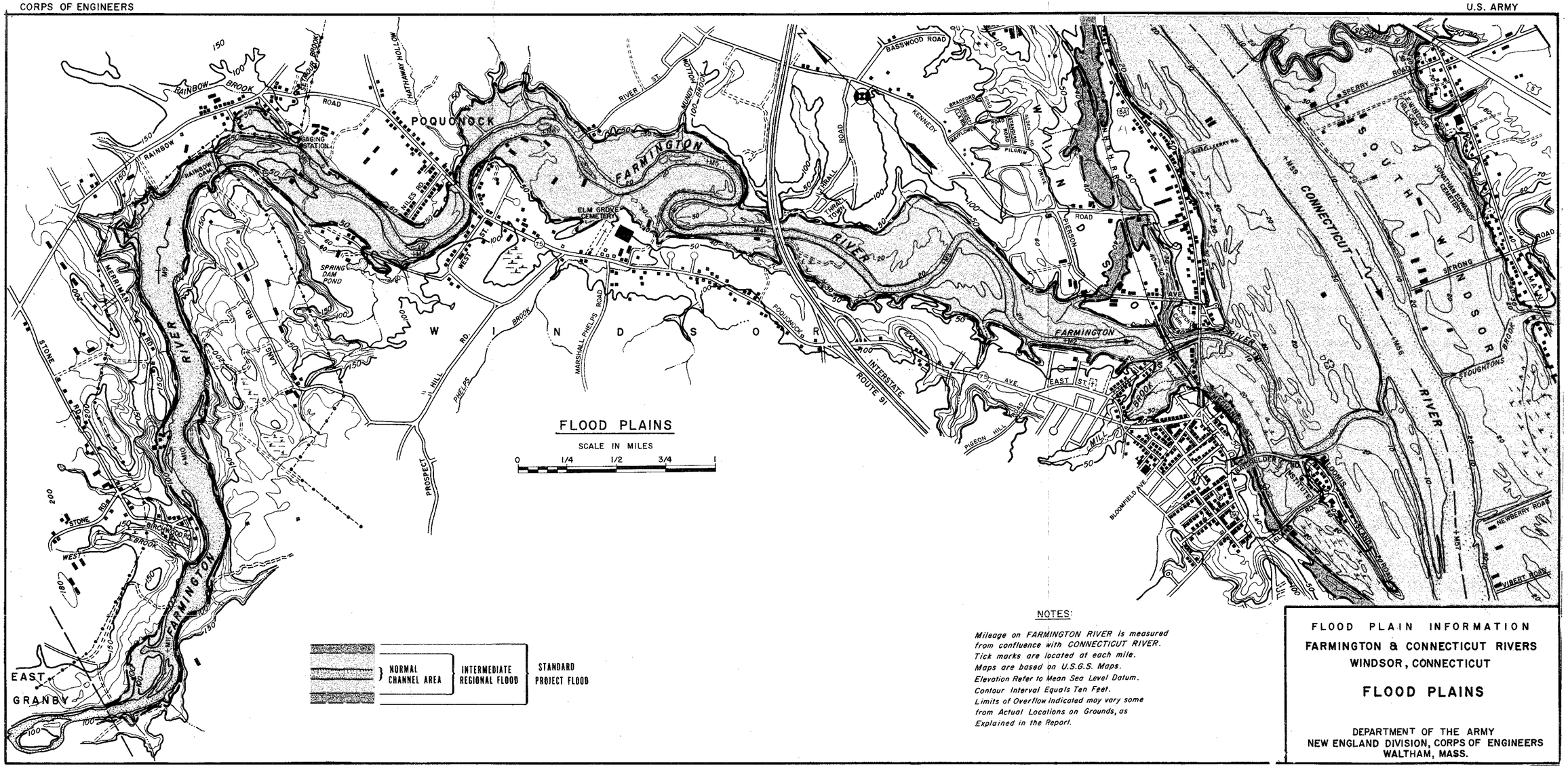
FLOOD PROFILES

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

PLATE NO. 5

CORPS OF ENGINEERS

U.S. ARMY



FLOOD PLAINS

SCALE IN MILES

0 1/4 1/2 3/4 1

NORMAL CHANNEL AREA

INTERMEDIATE REGIONAL FLOOD

STANDARD PROJECT FLOOD

NOTES:

Mileage on FARMINGTON RIVER is measured from confluence with CONNECTICUT RIVER.
Tick marks are located at each mile.
Maps are based on U.S.G.S. Maps.
Elevation Refer to Mean Sea Level Datum.
Contour Interval Equals Ten Feet.
Limits of Overflow Indicated may vary some from Actual Locations on Grounds, as Explained in the Report.

FLOOD PLAIN INFORMATION

FARMINGTON & CONNECTICUT RIVERS

WINDSOR, CONNECTICUT

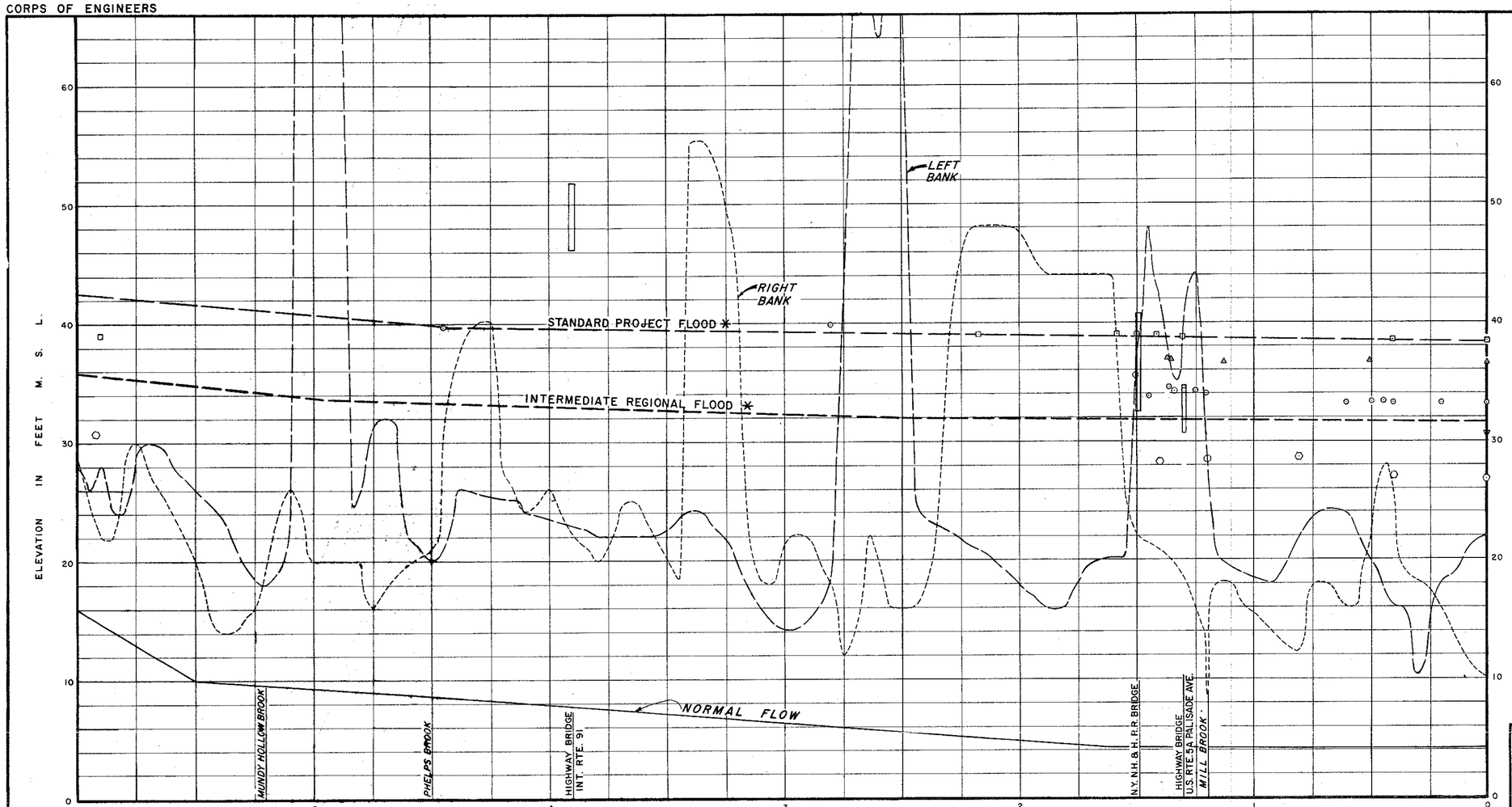
FLOOD PLAINS

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

PLATE NO. 6

CORPS OF ENGINEERS

U. S. ARMY



HIGH WATER MARKS

- ⊙ AUGUST 1955 FLOOD
- ⬡ DECEMBER 1948 FLOOD
- △ SEPTEMBER 1938 FLOOD
- □ MARCH 1936 FLOOD
- ▽ NOVEMBER 1927 FLOOD

NOTE:

* *Profile based on Colebrook River, Mad River and Sucker Brook Dams in operation.*

FLOOD PLAIN INFORMATION

FARMINGTON RIVER

WINDSOR, CONNECTICUT

FLOOD PROFILES

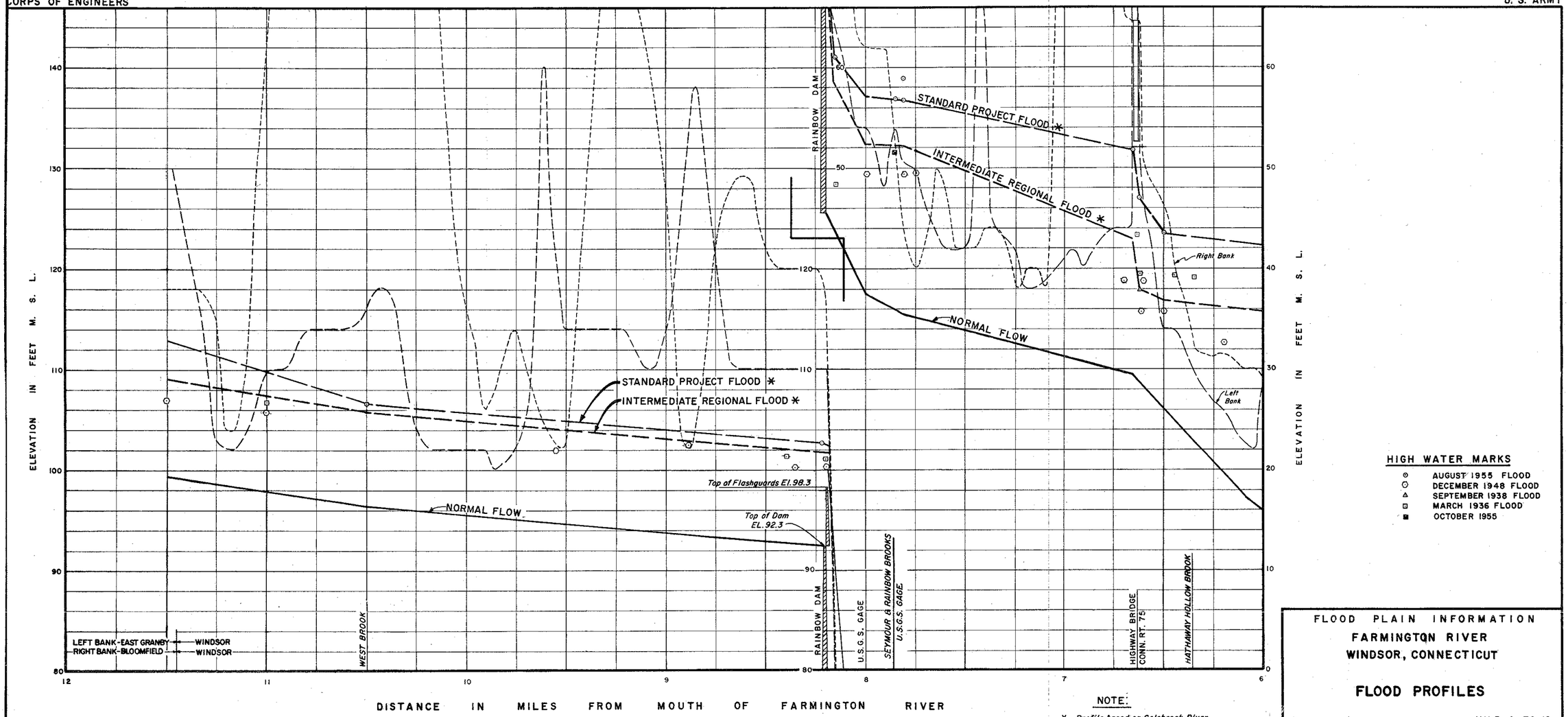
MILE 1 TO 6

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

PLATE NO. 7

CORPS OF ENGINEERS

U. S. ARMY



HIGH WATER MARKS

- ⊙ AUGUST 1955 FLOOD
- ○ DECEMBER 1948 FLOOD
- △ SEPTEMBER 1938 FLOOD
- ▫ MARCH 1936 FLOOD
- ▪ OCTOBER 1955

NOTE:

* *Profile based on Colebrook River, Mad River and Sucker Brook Dams in operation.*

FLOOD PLAIN INFORMATION

FARMINGTON RIVER

WINDSOR, CONNECTICUT

FLOOD PROFILES

MILE 6 TO 12

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

PLATE NO. 8